Nominal and serendipitous GOMOS data:

O_3, NO_2, NO_3, PSC's, metallic layers and others…

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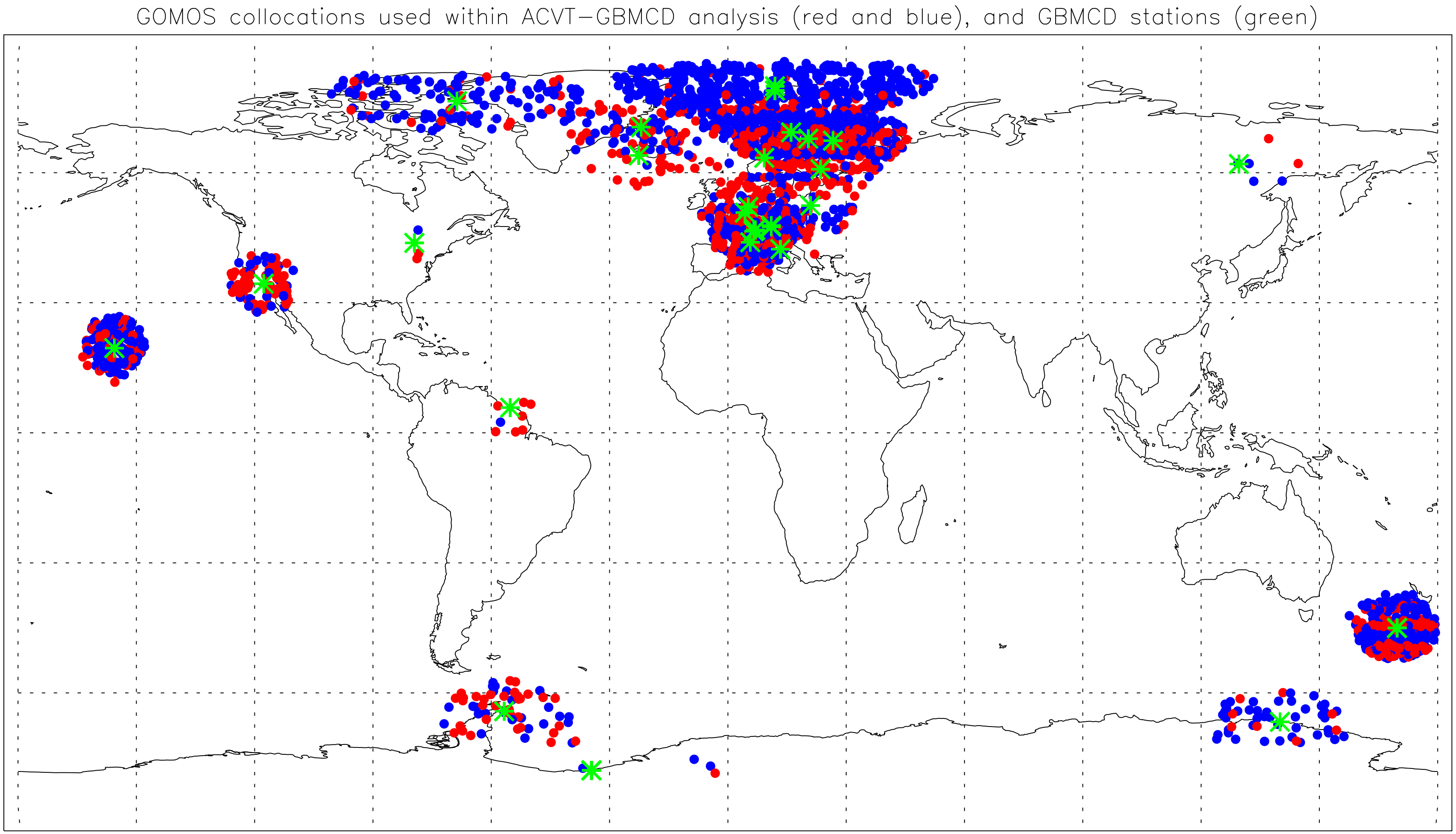
SOSST meeting @ Boulder [15-17 June 2004]

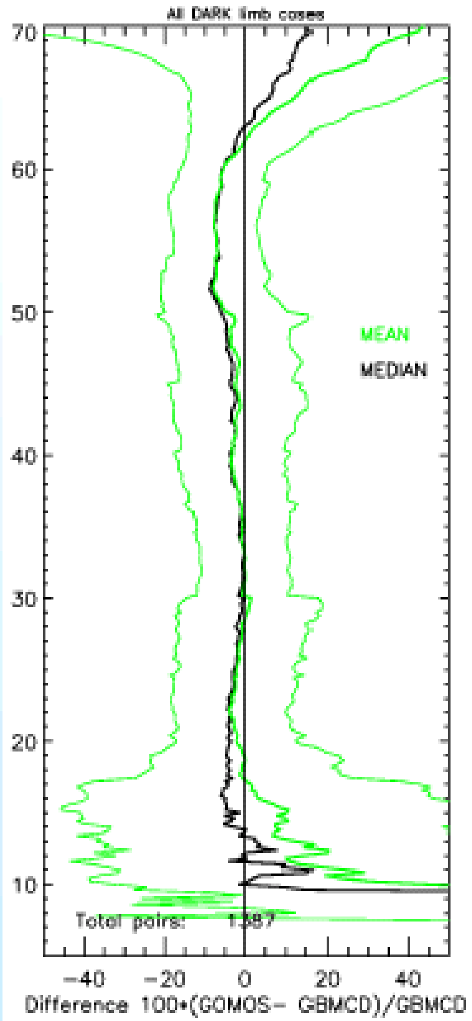
GOMOS ozone data (v6.0a/april 2004) collocated with ground based measurements

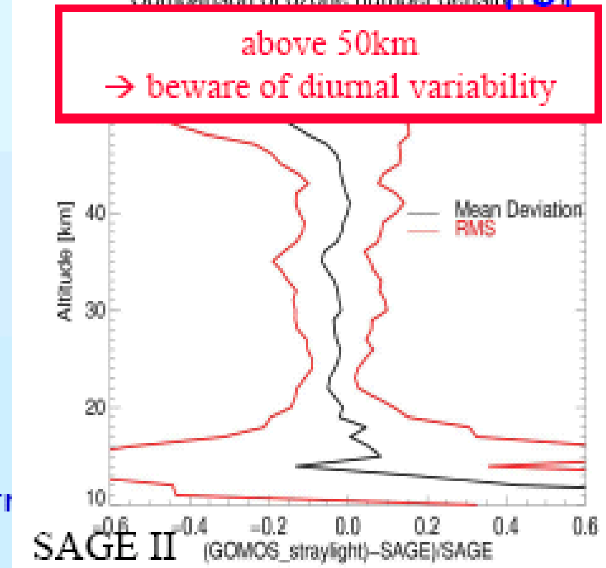


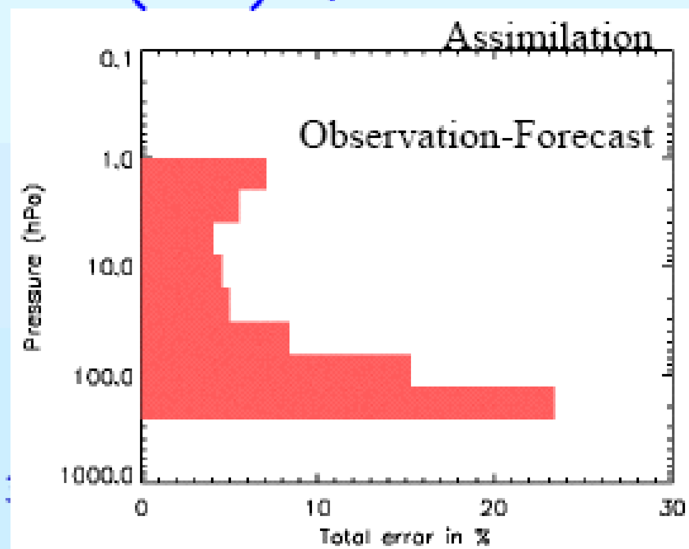
http://www.fr-acri.com/gomval_web/index.html

Ozone

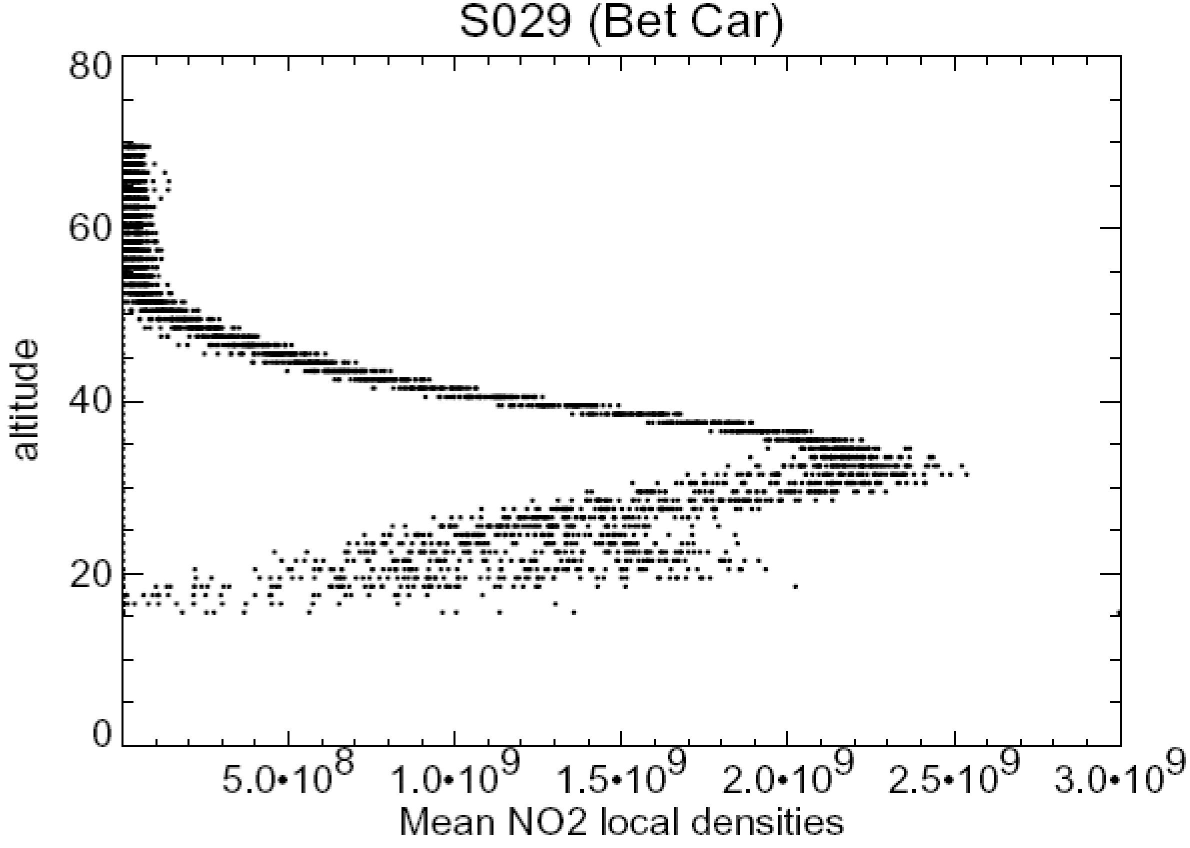
- Comparison with ground-based and satellite solar/lunar occultations:
  - → 0 to -5% bias in range 18-50km
  - → RMS with respect to reference ground based data sets: 10-15% (18-50km)
    SAGE II: 5-15% (≈20-50km)
  - → assimilation: precision <5% (25-40km) for ≈60%(tbc) of data



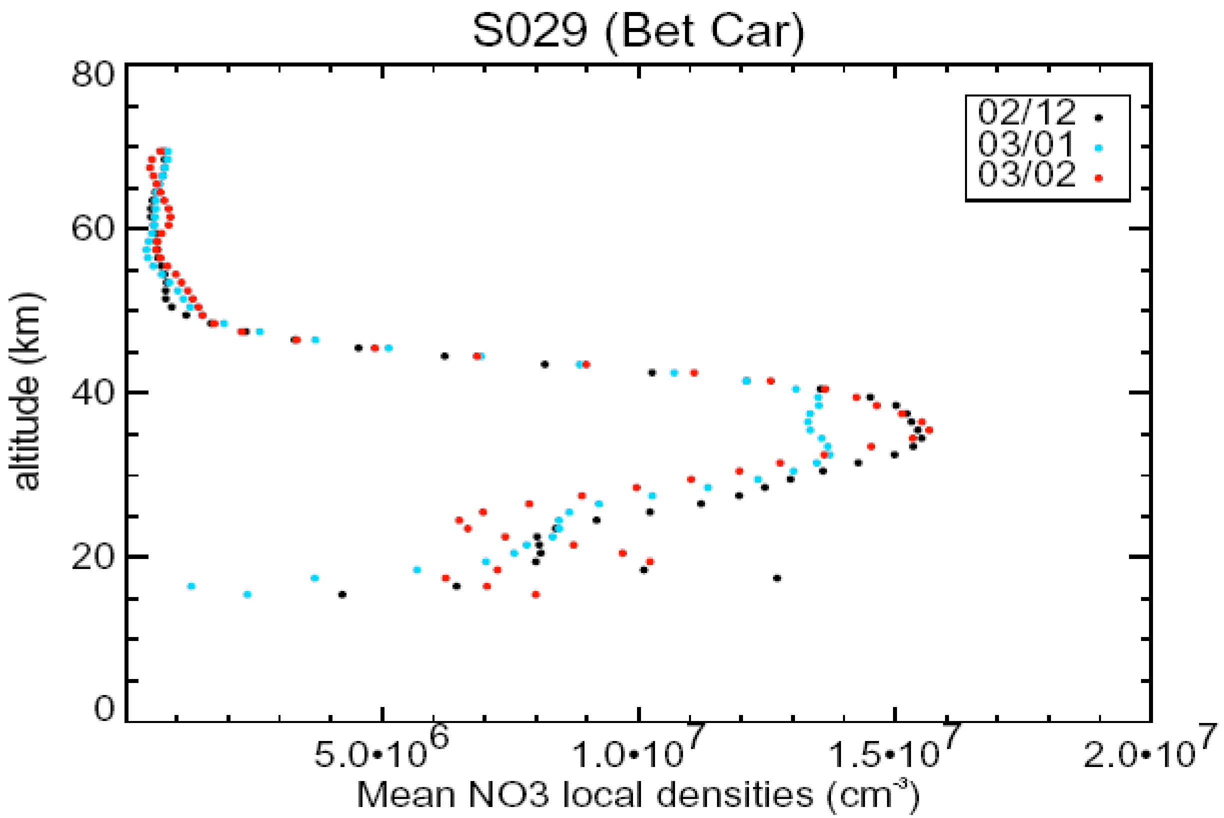




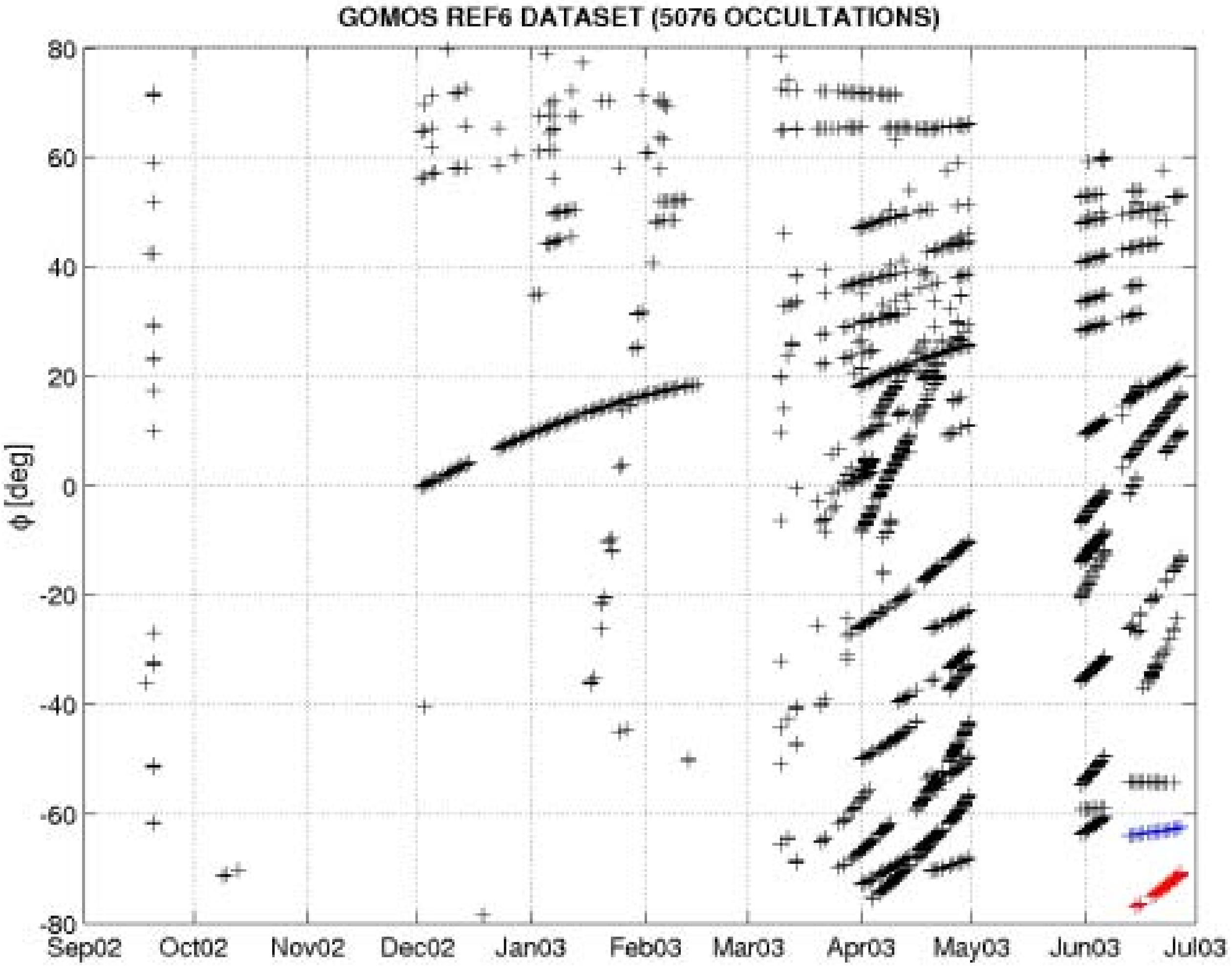
63 daily average spread over 79 days , sampled on a common vertical grid for one single star (near equator)

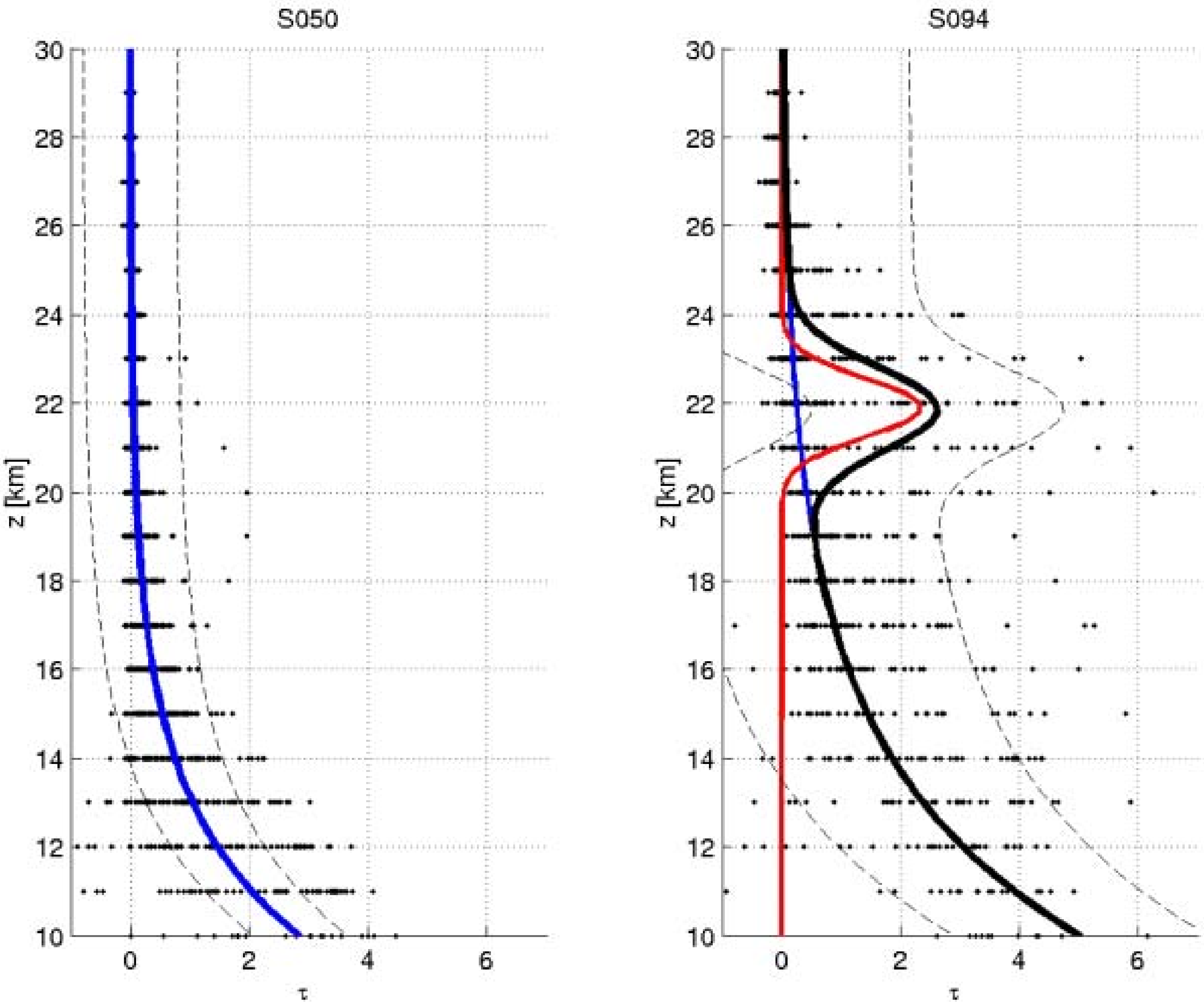


3 different monthly average (dec.02, jan.03, Feb.03) sampled on a common vertical grid for one single star (near equator)

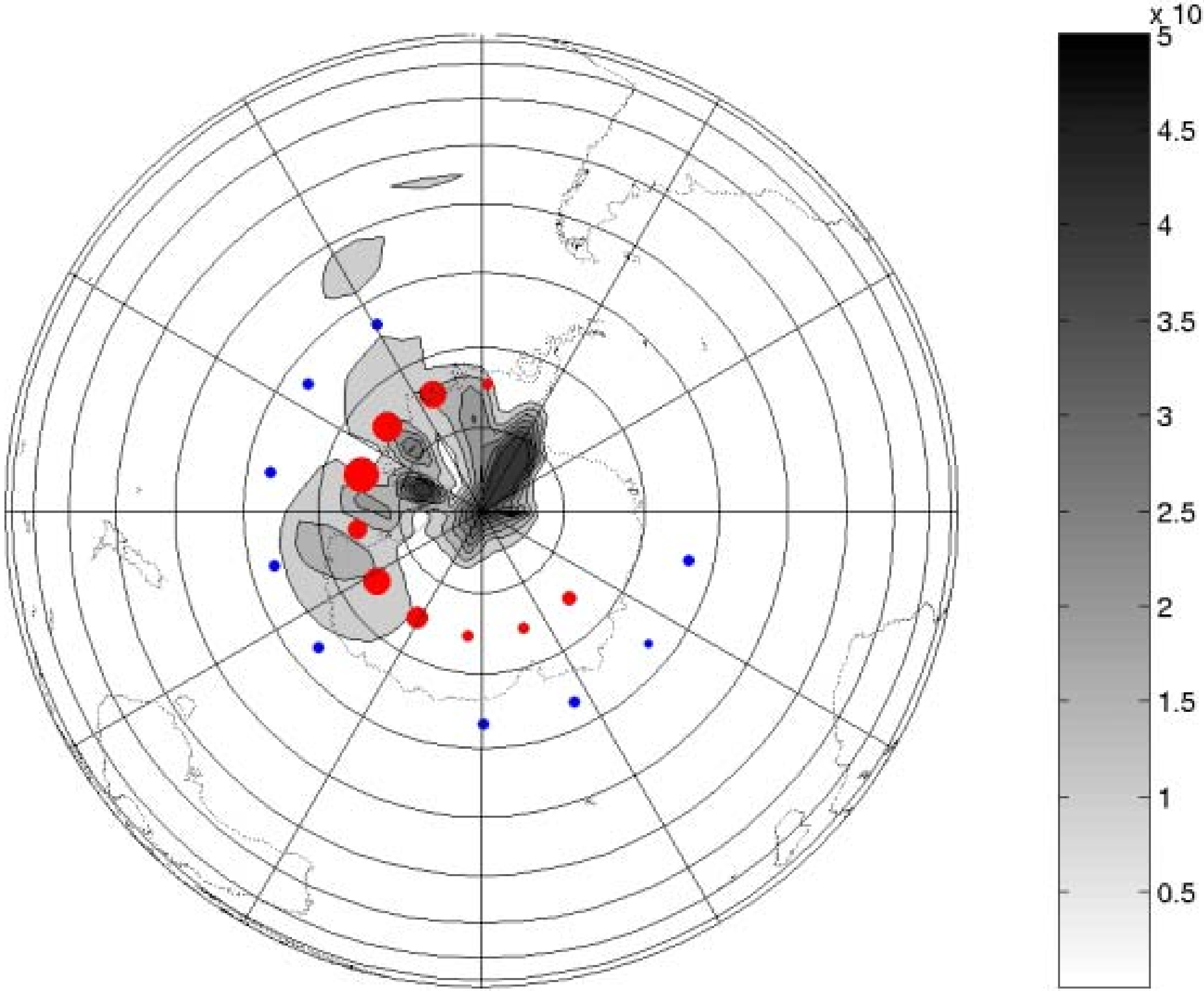


REF6 DATA SET (~5000 OCCULTATIONS)

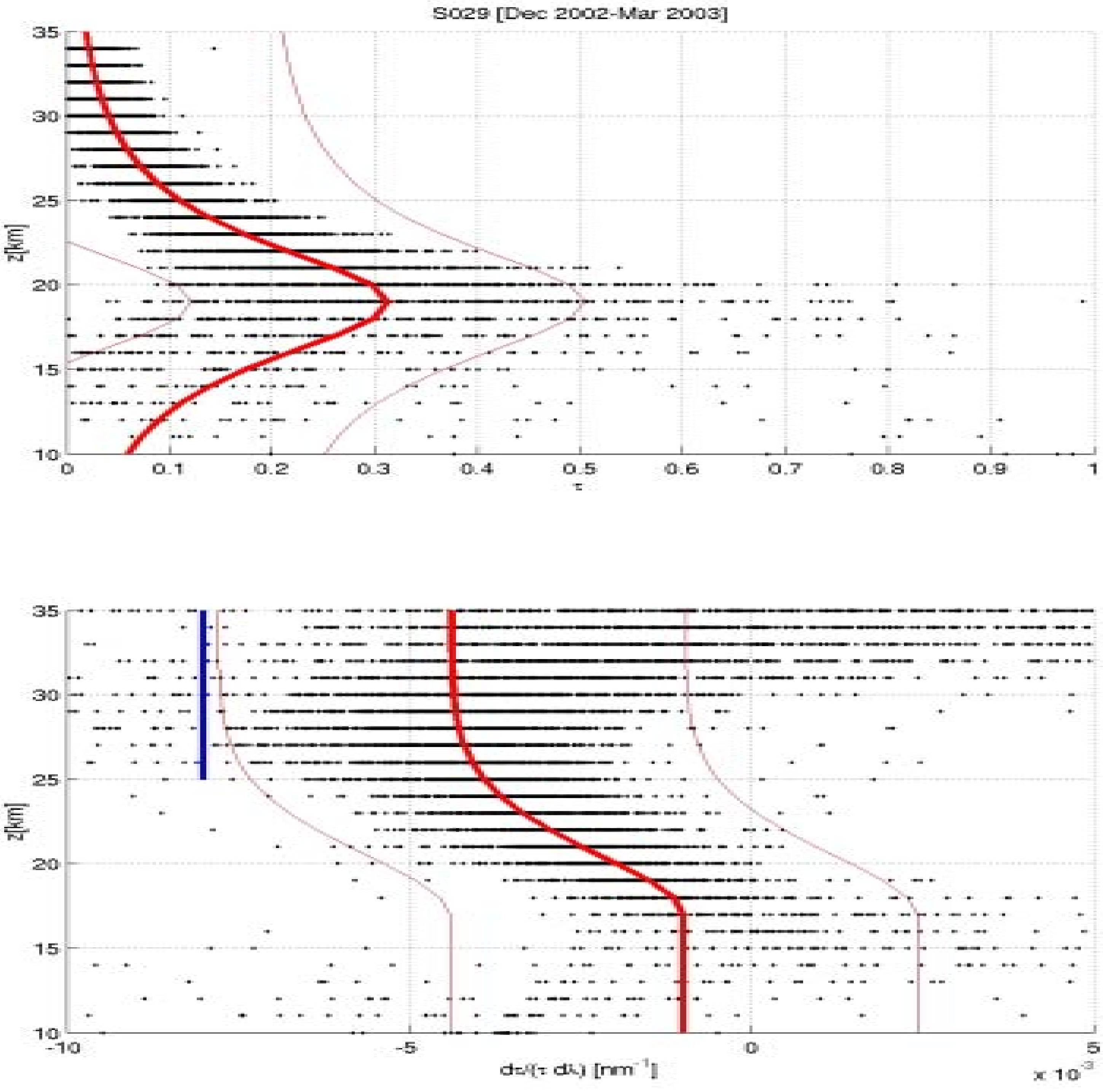




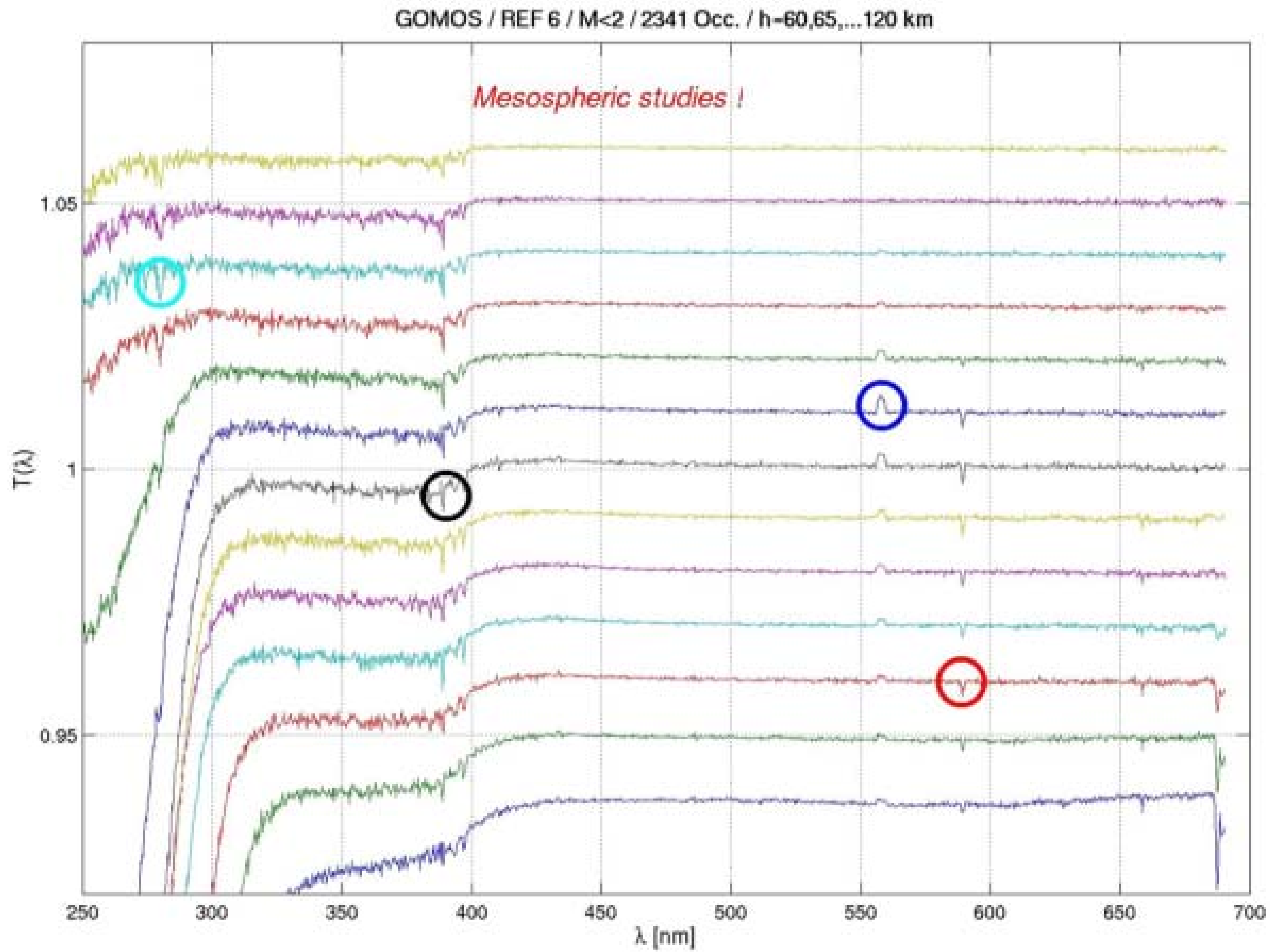
S050
S094
z [km]
τ
30
28
26
24
22
20
18
16
14
12
10
0
2
4
6



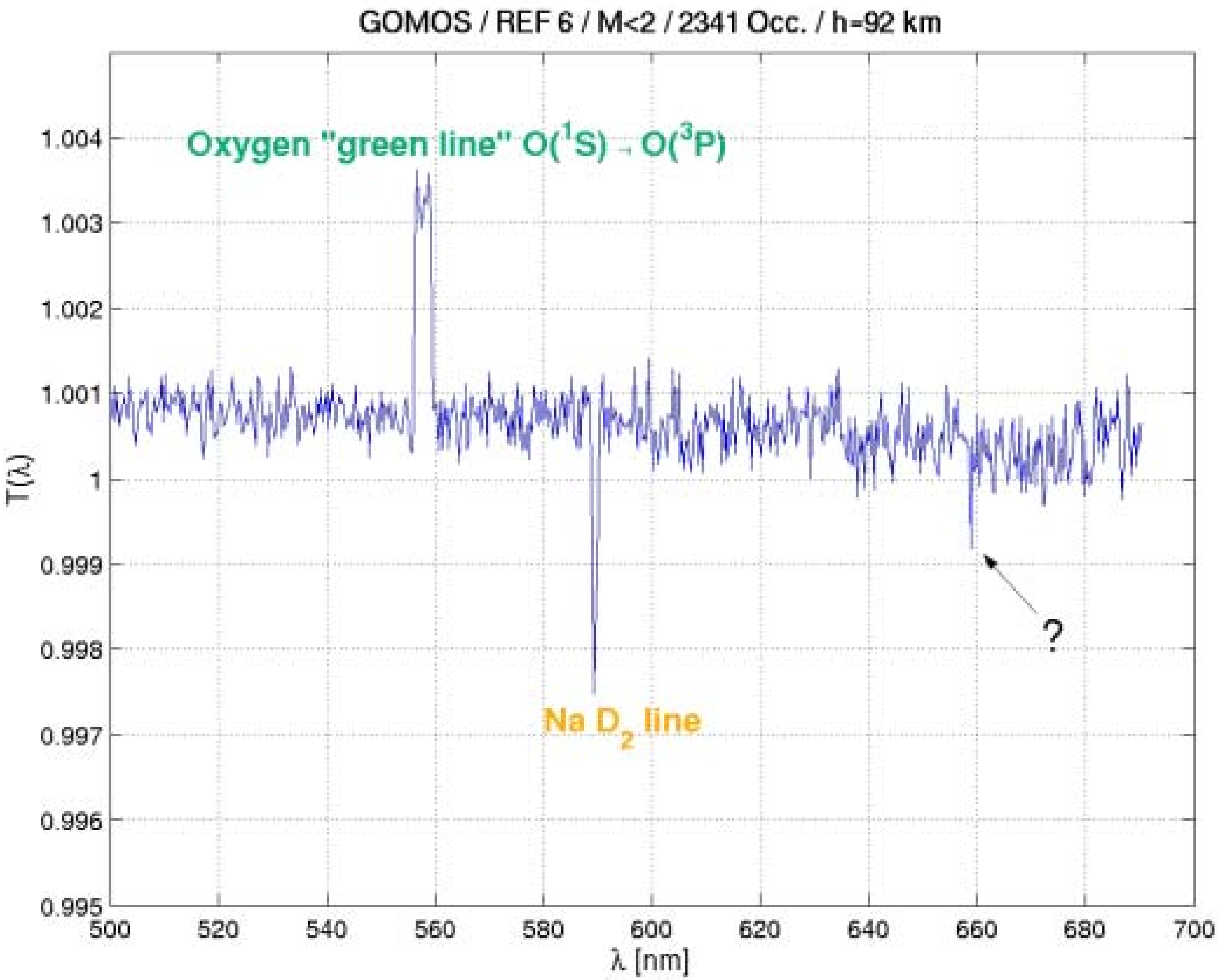
x 10^-8
5
4.5
4
3.5
3
2.5
2
1.5
1
0.5



S029 [Dec 2002-Mar 2003]
z[km]
τ
z[km]
dτ/(τ dλ) [nm⁻¹]
x 10⁻³

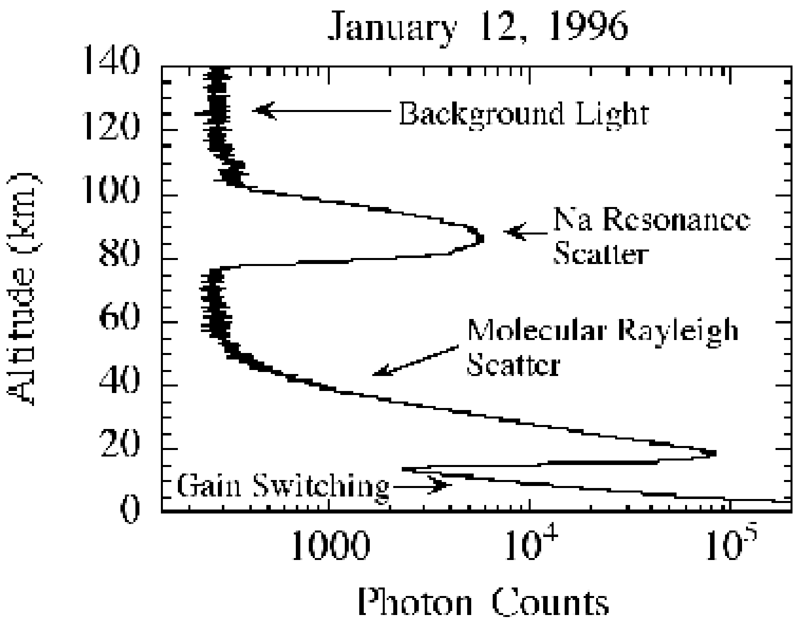


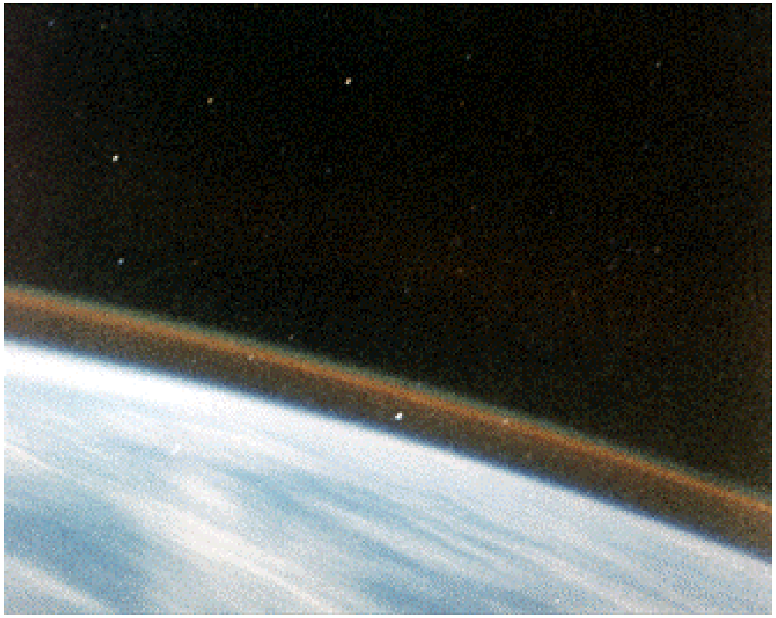
GOMOS / REF 6 / M<2 / 2341 Occ. / h=60,65,...120 km
Mesospheric studies !
T(λ)
1.05
1
0.95
250
300
350
400
450
500
550
600
650
700
λ [nm]



GOMOS / REF 6 / M<2 / 2341 Occ. / h=92 km
Oxygen "green line" O(1S) → O(3P)
Na D2 line
?
T(λ)
λ [nm]

MESOSPHERIC SODIUM LAYER





Meteoric metal layers (Fe, Na, K, Ca,..) formed by ablation of shooting stars. Destruction by recombination with O, O_2, O_3.

Geophysical importance of mesospheric metallic layers

- wind/waves dynamical signatures
- Metallic layers could be the source of nucleation seed of polar mesospheric clouds [« Removal of Meteoritic Iron on Mesospheric Clouds » by Plane et al., Science, vol 304, pp 426-428, [16 April 2004]
- adaptive optics …

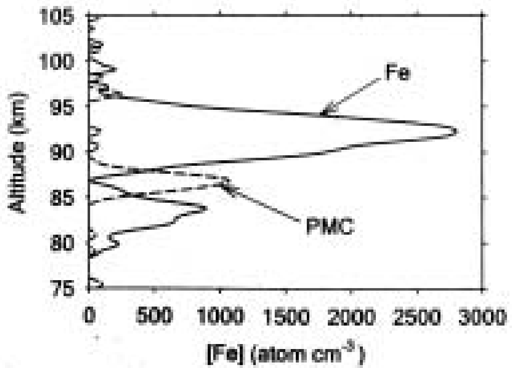
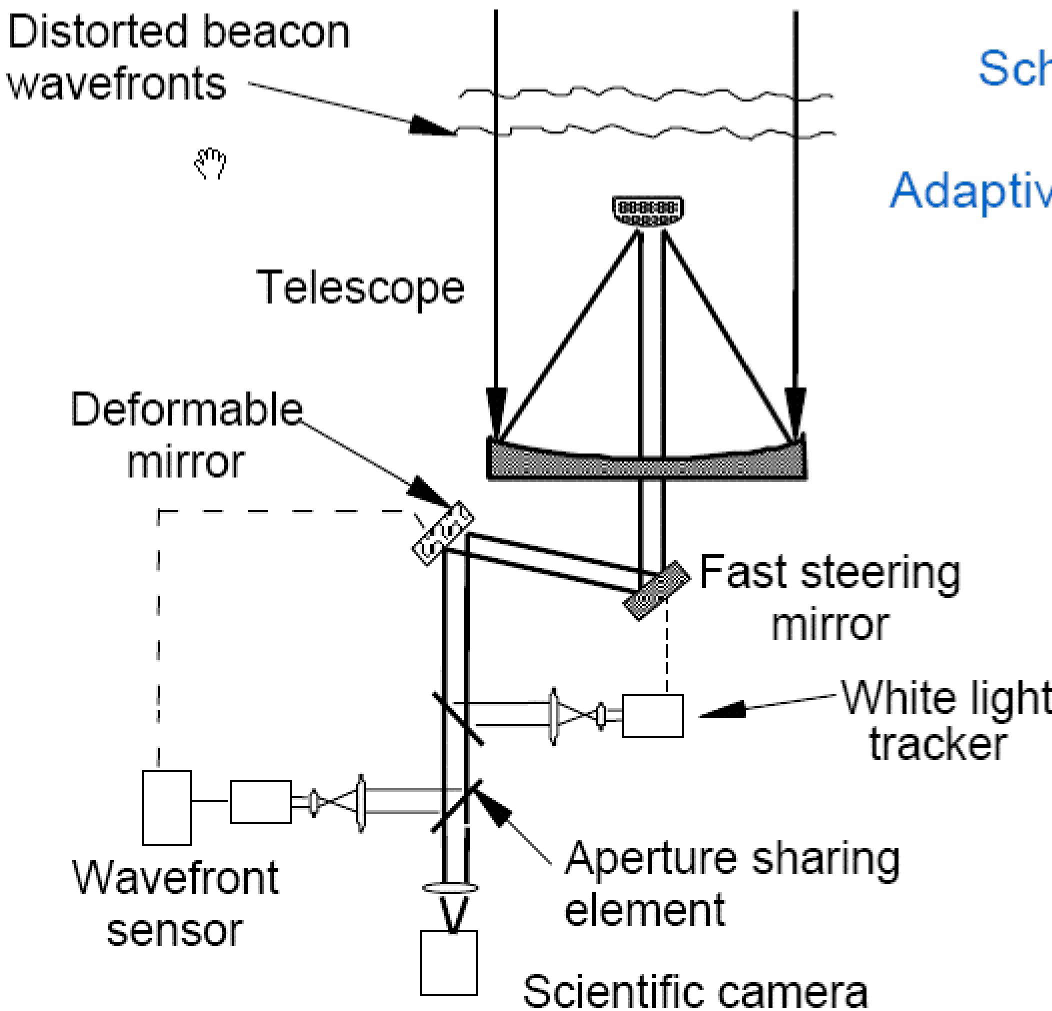


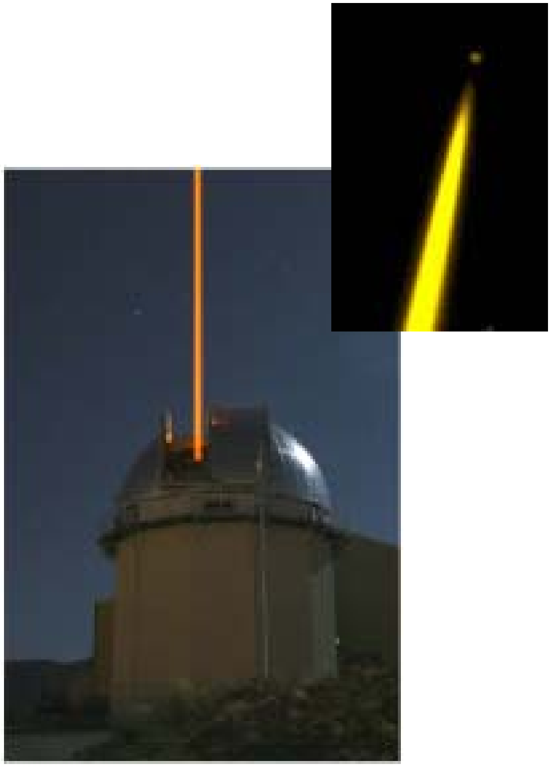
Fig. 1. Simultaneous observations of the atomic Fe density and PMC backscatter signal. The measurements were made with the University of Illinois Fe Boltzmann lidar, operating at 372 and 374 nm, respectively. The signals are averaged between 03:00 and 06:00 UT on 19 January 2000. The PMC backscatter signal is expressed as equivalent Fe atoms cm^{-3} for comparison with the atomic Fe resonance fluorescence signal.

The importance of the mesospheric layer for astronomy:

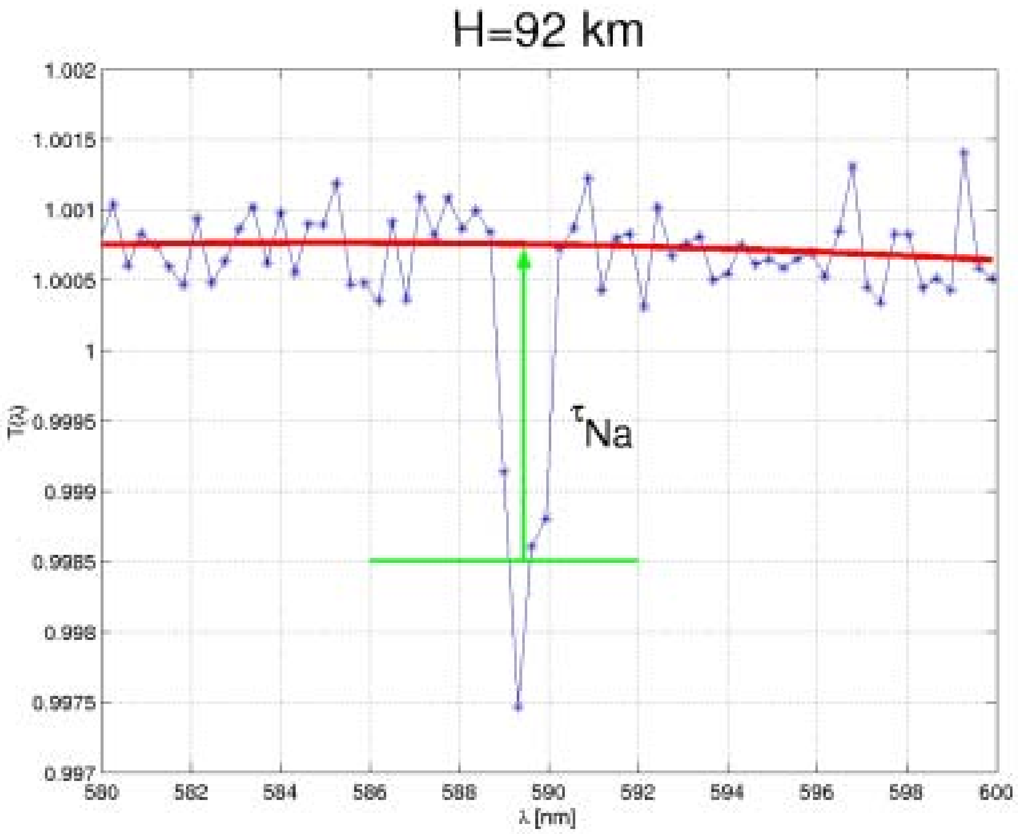
let’s use sodium beacons!



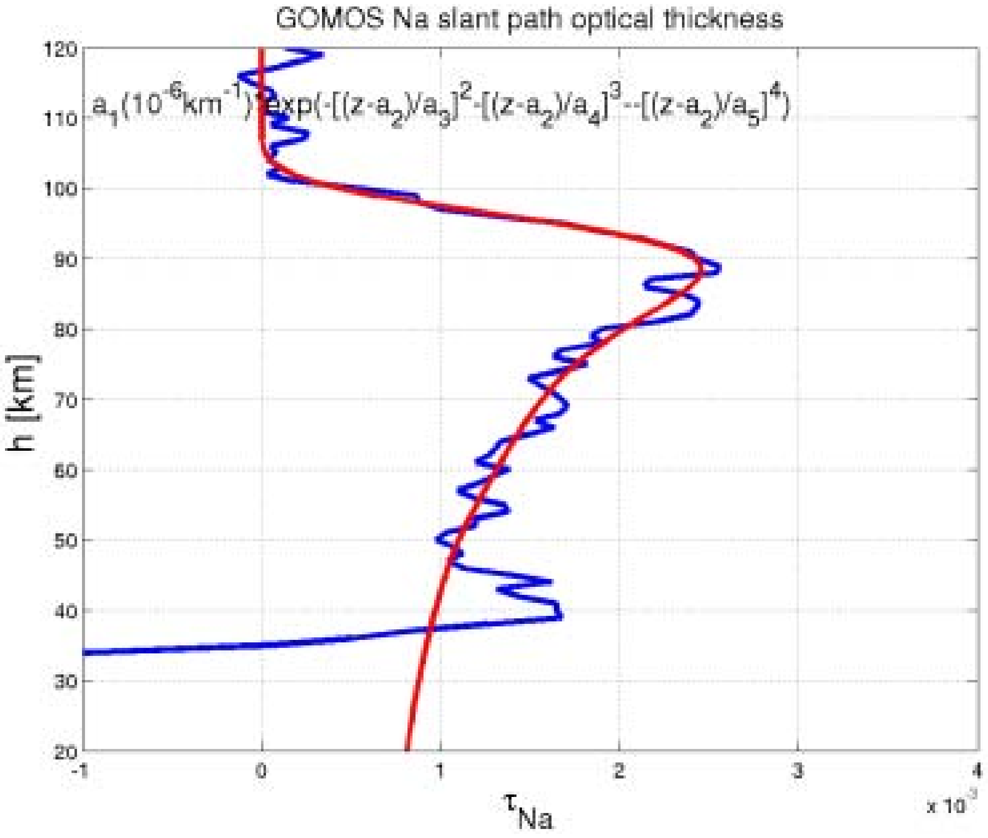
Schematic Diagram
of
Adaptive Optical Telescope



Na slant path optical thickness can be extracted by simple DOAS technique…



…and vertically inverted and …



Best LM fit

a_1=3.73

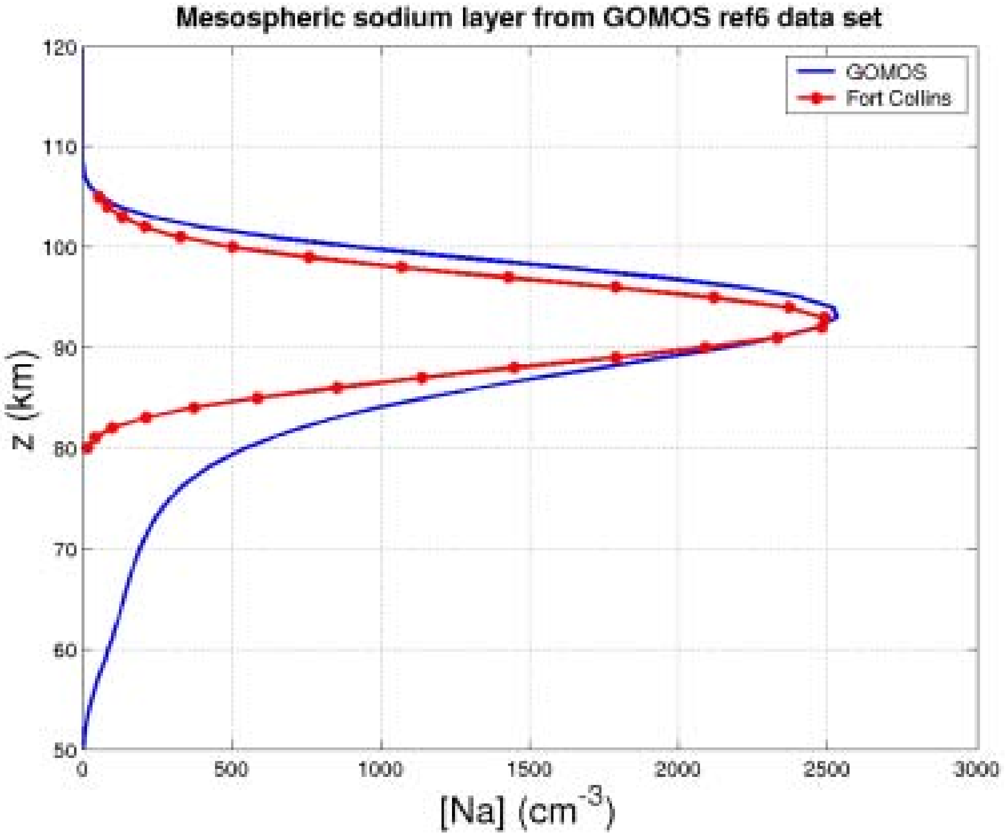
a_2=93.4 km

a_3=7.66 km

a_4=10.9 km

a_5=17.5 km

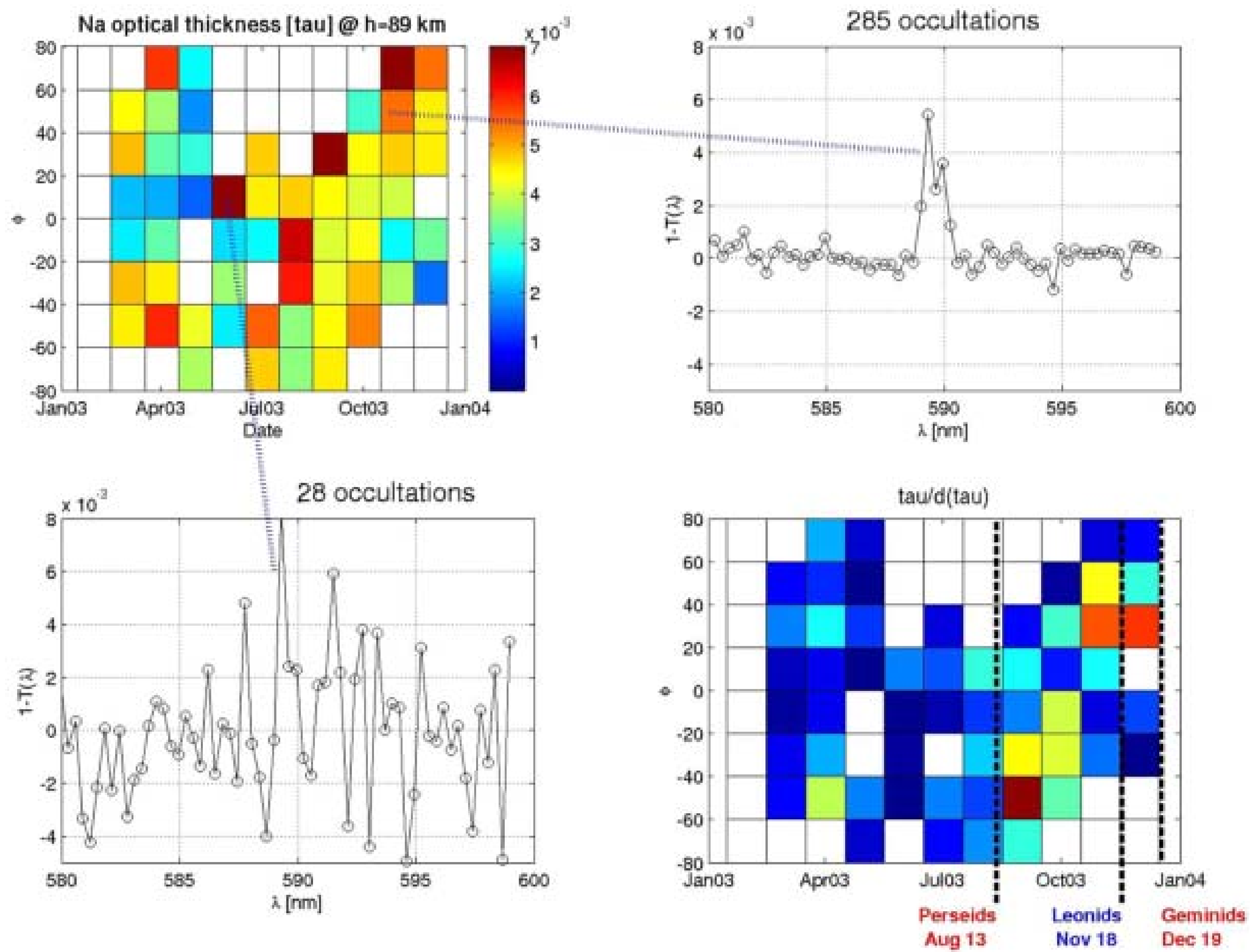
…successfully compared .



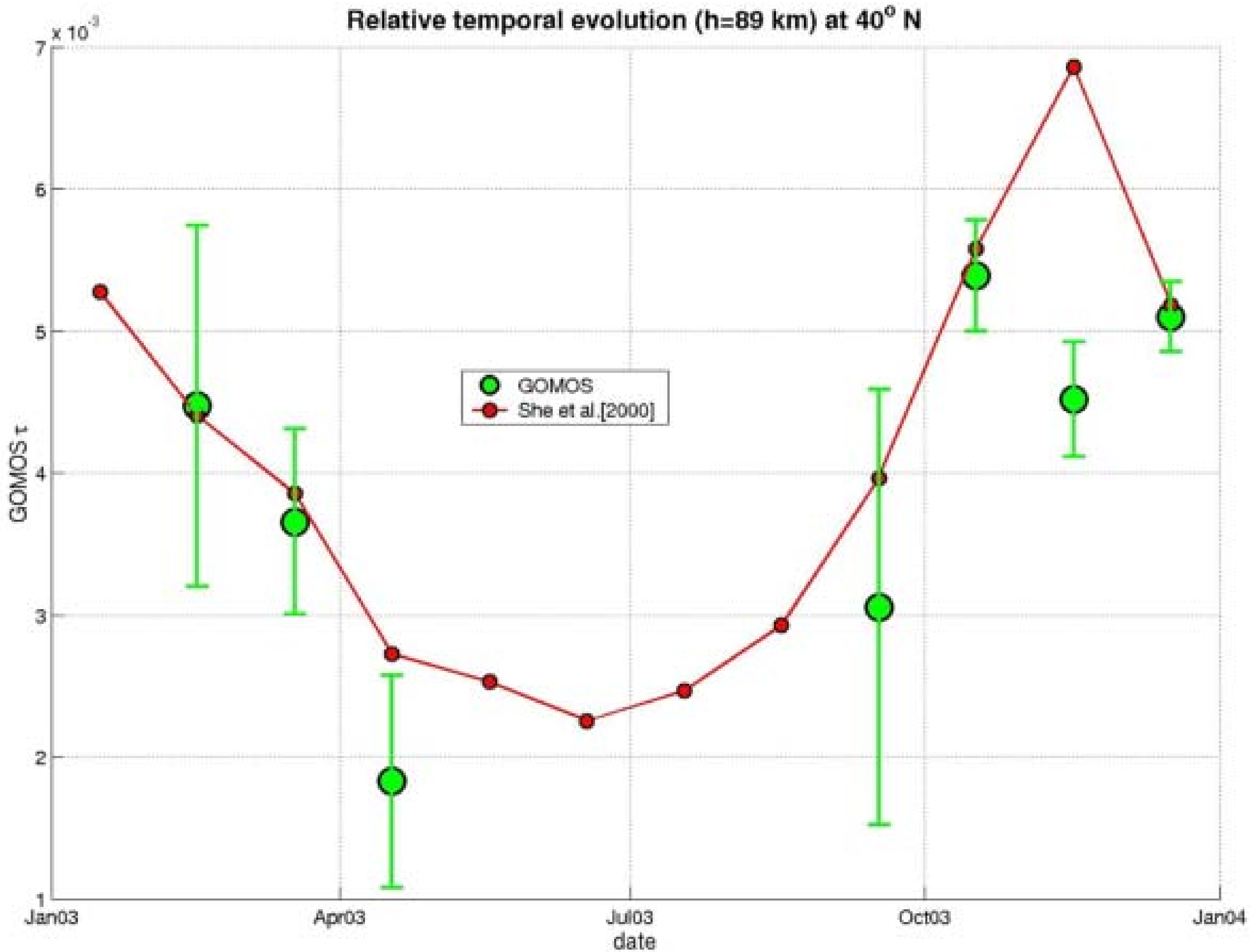
Data compared with Na lidar climatology at Fort Collins (41° N / April)

She & al. GRL, 27, 3289, [2000]

« Eight-year climatology of nocturnal temperature and sodium density in the mesopause region over Fort Collins »



Na optical thickness [tau] @ h=89 km
285 occultations
28 occultations
tau/d(tau)
1-T(λ)
λ [nm]
Date
φ
Jan03
Apr03
Jul03
Oct03
Jan04
Perseids
Aug 13
Leonids
Nov 18
Geminids
Dec 19



Relative temporal evolution (h=89 km) at 40° N
x 10^-3
7
6
5
4
3
2
1
GOMOS τ
GOMOS
She et al.[2000]
Jan03
Apr03
Jul03
Oct03
Jan04
date

Conclusions

- O_3, NO_2 and NO_3: clear improvement
- « small » constituents like aerosols can be detected and exploited (proxies of PSC, PMC and background emissions)
- Many interesting features detected at fine spectral scale (emission, metallic absorbers,..etc)
- 1 000 000 occultations is not too much !!!